Welcome to AP Statistics! This course is like no other mathematics course in that the emphasis is placed on your ability to think, reason, explain, and support as opposed to performing calculations.

Advanced Placement courses are designed to expose you to college level curriculum and higher expectations. This requires a great amount of planning from your teacher and a greater amount of responsibility and commitment from you.

One of the responsibilities you have accepted in taking an AP course is this summer work packet. The packet has two parts:

1. Part 1: fundamentals and review of Algebra topics (Weeks 1-6)
2. Part 2: practice problems with data. (Weeks 7 and 8)

You will begin to review old concepts and explore new ones before you walk back into the classroom next fall. If you follow the pace recommended in this packet you will not need to spend more than about an hour per week completing this packet. You will be tested on the material contained in this packet in the first week of school after you have had the opportunity to ask your teacher questions. If you decide to put off doing this work you will be piling up work for yourself in late August. I want you to be successful! So please follow the time guidelines in this packet. This packet will count as half (50%) of your test score.

AP Statistics requires the use of a graphing calculator during the year. I recommend the TI-84. You will need it for this packet, so please acquire one. There are TI-84 emulators available for smartphones as well. These can be used at home and during assignments, but not on assessments.

I will be contacting you via email and the Remind text messaging service throughout the summer. You can join the class on Remind by following this link. [https://www.remind.com/join/74fa](https://www.remind.com/join/74fa)

Contact Mr. Shenk via email: [dshenk@hannasd.org](mailto:dshenk@hannasd.org) or through Remind with any questions or concerns.

Enjoy your summer!
Week 1: July 1-7

Was that fair?

This is a question that statistics can help answer. Statistics is the science of learning from data. So what is data? Data are usually numbers, but they are not “just” numbers. Data are numbers with a context. The number 10.5, for example, carries no information by itself. But if we hear that a family friend’s new baby weighed 10.5 pounds at birth, the number now has meaning and context.

One of the things students find most surprising about their first statistics course is how much they work with WORDS and not just numbers like a typical math course. Students must therefore learn to READ for context and express answers (WRITE) in terms of context.

What follows are actual questions from AP Statistics exams. Read through the AP questions and then answer the questions that follow about the context of the questions.

Nine sales representatives, 6 men and 3 women, at a small company wanted to attend a national convention. There were only enough travel funds to send 3 people. The manager selected 3 people to attend and stated that the people were selected at random. The 3 people selected were women. There were concerns that no men were selected to attend the convention.

a.) How many total sales representatives are considered in this problem?

b.) How did the manager select the 3 people?

c.) What is the concern?

d.) Calculate the probability of selecting all 3 women.

e.) Based on your answer to part d.) is there reason to doubt the manager’s claim that the 3 people were selected at random? Explain.

Researchers often mark wildlife in order to identify particular individuals across time or space. A study of butterfly migration is designed to determine which location on the butterflies’ wings is best for marking. The six possible locations are those shown as A through F in the figure below. The butterfly in the figure is a monarch (Danaus plexippus).
a.) What type of butterfly is represented in the figure?

b.) How many butterflies does the researcher plan to mark and release?

c.) How many butterflies should be marked in location A?

d.) Why do the researchers need to mark butterflies in different locations?

e.) Describe location D on the butterfly?

f.) How is location C different from location D?

g.) Why do researchers mark wildlife?

h.) Name another type of butterfly that migrates? You may need to do a bit of research to answer this question.

Week 2: July 8-14

Do pets or friends help reduce stress?
Some of the numbers you encounter in your statistics class will be familiar to you. You have worked with them before. Measures of the CENTER of the data like the mean, median and mode should be numbers in statistics you have worked with before.

**Data Set 1:** 5, 4, 13, 10, 6, 2, 5, 2, 7, 9, 3

**Data Set 2:** 105, 123, 107, 115, 100, 109

**Mean:** average, you add all the numbers and divide by how many there are.

Ex. Data Set 1: \[
\frac{5+4+13+10+6+2+5+2+7+9+3}{11} = 6
\]

Ex. Data Set 2: \[
\frac{105+123+107+115+100+109}{6} = 109.833
\]

**Median:** the data value in the middle. If the data is odd it will be a specific data value. If the data is even you will need to average the two middle numbers. You must put the data in order from smallest to largest before you can find the median.

Ex. Data Set 1: 2, 2, 3, 4, 5, 6, 7, 8, 10, 13

The median for Data Set 1 is 5.

Ex. Data Set 2: 100, 105, 107, 109, 115, 123 \[\rightarrow\] Average 107 and 109: \[
\frac{107+109}{2} = 108
\]

The median for Data Set 2 is 108.

**Mode:** the mode is the data value that occurs most frequently. If every value occurs with equal frequency there is no mode, you can have one mode or many modes.

Ex. Data Set 1: 2, 2, 3, 4, 5, 6, 7, 8, 10, 13

The mode for Data Set 1 is 2 and 5.

Ex. Data Set 2: 100, 105, 107, 109, 115, 123

There is no mode for Data Set 2.

**If you have a TI-84, practice using STAT \(\rightarrow\) Edit to enter your data into L1 and then STAT \(\rightarrow\) CALC \(\rightarrow\) 1-Var Stats \(\rightarrow\) Calculate to have the calculator perform the tasks (except mode) for you.**

In AP Statistics, data sets are usually given in the context of a situation, not just raw data.

To examine the effects of pets and friends in stressful situations, researchers recruited 45 women who were dog lovers. Fifteen were assigned at random to each of three groups: to do a stressful task alone, with a good
friend present or with their dog present. The woman’s average heart rate (bpm) was the measure of the effect of stress. The table below represents the data.

Pet (P), Friend (F) and Alone (C)

<table>
<thead>
<tr>
<th>Group</th>
<th>Rate</th>
<th>Group</th>
<th>Rate</th>
<th>Group</th>
<th>Rate</th>
<th>Group</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>69</td>
<td>P</td>
<td>69</td>
<td>C</td>
<td>85</td>
<td>C</td>
<td>75</td>
</tr>
<tr>
<td>F</td>
<td>100</td>
<td>C</td>
<td>87</td>
<td>C</td>
<td>85</td>
<td>C</td>
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<td>P</td>
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<td>P</td>
<td>64</td>
<td>P</td>
<td>59</td>
<td>P</td>
<td>70</td>
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<tr>
<td>C</td>
<td>80</td>
<td>C</td>
<td>92</td>
<td>P</td>
<td>80</td>
<td>F</td>
<td>88</td>
</tr>
<tr>
<td>C</td>
<td>87</td>
<td>C</td>
<td>88</td>
<td>P</td>
<td>69</td>
<td>F</td>
<td>82</td>
</tr>
<tr>
<td>P</td>
<td>76</td>
<td>F</td>
<td>91</td>
<td>C</td>
<td>73</td>
<td>F</td>
<td>87</td>
</tr>
<tr>
<td>F</td>
<td>83</td>
<td>F</td>
<td>101</td>
<td>C</td>
<td>85</td>
<td>F</td>
<td>92</td>
</tr>
<tr>
<td>F</td>
<td>102</td>
<td>C</td>
<td>78</td>
<td>C</td>
<td>71</td>
<td>P</td>
<td>72</td>
</tr>
<tr>
<td>P</td>
<td>86</td>
<td>P</td>
<td>98</td>
<td>F</td>
<td>90</td>
<td>P</td>
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<td>F</td>
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<td>C</td>
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<td>F</td>
<td>101</td>
<td>F</td>
<td>77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>99</td>
<td>F</td>
<td>97</td>
<td>P</td>
<td>70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a.) Find the mean, median and mode of those who did the stressful task with a pet.

b.) Find the mean, median and mode of those who did the stressful task with a friend.

c.) Find the mean, median and mode of those who did the stressful task alone.

d.) Do pets help reduce stress? Do friends? Support your response with data and context.
Is there too much sugar in cereal?

In AP Statistics we will need to be able to read and create many graphs. Graphs are a way to display and organize data. There will be graphs that you have encountered in the past and new graphs to discover. One graph that you have likely encountered in the past is a BOXPLOT (or box-and-whiskers).

Below is a diagram of a boxplot with an explanation of the values represented in the boxplot.

Below is a boxplot that appeared recently on an AP exam.

a.) Approximate the median salary for a person who works for corporation B.

b.) Approximate the largest salary for a person who works for corporation B.

c.) The Interquartile Range is the 3rd quartile minus the 1st quartile. Approximate the Interquartile Range for Corporation B.

The Boxplots below represent a sample of cereals with a 1 cup serving size and a ¾ cup serving size.
a.) What is the approximate median sugar content for cereals with a 1 cup serving size?

b.) What is the approximate median sugar content for cereals with a ¾ cup serving size?

c.) In AP Statistics we will be asked to COMPARE distributions and we want to use QUANTIFIERS. So...which serving size has a HIGHER median sugar content?

d.) The Interquartile Range is also the length of the BOX in a boxplot. What is the Interquartile Range (IQR) for cereals with a 1 cup serving size?

e.) What is the IQR for cereals with a ¾ cup serving size?
**Week 4: July 22-28**

**Graphs, graphs, graphs**

In Statistics we organize and display data using graphs. We will teach you how to read, create and interpret many graphs. We will practice this summer using published graphs and charts from internet sites and news organizations. They assume you know how to interpret the data...or...do they count on you not understanding data displays?

a.) What percent of Americans do NOT trace their ancestry to European descent (German, Irish or English)?

b.) USA Today stated, “More Americans trace their roots to Europe more than anywhere else in the world.” is that a valid statement based on the graph?

---------------------------------------------------------------------------------------------------------------------

a.) What impression does this graph give you? Is it accurate? Explain.

b.) How could the graph be improved?

A survey was conducted of AP Statistics students who own a video game system. They were asked which video game system they bought most recently. The data is displayed in the bar graph below.
a.) How many people are represented in this graph?

b.) How many people own a PS3?

c.) What proportion of students own a PS3?

d.) What proportion of students own an Atari or an Xbox 360?

e.) Write two sentences that describe two different characteristics of this graph.

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**Week 5: July 29 – August 4**

*Do you have probability-phobia?*
One of the more challenging topics we will cover in AP Statistics is the concept of probability. Probability requires you to use some basic logic. The major issue students have with probability is that while some of the mathematics that govern it “make sense,” other parts require students to gain new perspective. The use of formulas helps us obtain the correct answer before we gain this intuition. The good news is, you probably already have some experience with probability for your earlier studies.

The following probabilities can be calculated using techniques you should already know.

![Tasty Candy](image)

a.) What is the probability of selecting a cherry piece?

b.) What is the probability of selecting a lemon piece?

c.) What is the probability of selecting a cherry or lemon piece?

d.) What is the probability of choosing two lemon pieces in a row, assuming you ate the first one before you chose the second one?

e.) Mr. Shenk does not like cherry candies. What is the probability that he chooses a cherry, puts it back in the box, and then chooses cherry again?
The following probabilities rely on using proportions from a table. The table displays the probabilities for the problem instead of frequencies/counts/numbers.

Below is a table of past records giving probability data for a driver having an accident and whether or not it was raining at the time.

<table>
<thead>
<tr>
<th></th>
<th>Rain</th>
<th>No Rain</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accident</td>
<td>0.025</td>
<td>0.015</td>
<td></td>
</tr>
<tr>
<td>No Accident</td>
<td>0.335</td>
<td>0.625</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

a.) What is the probability of rain?

\[ P(\text{rain}) = \] ________________

b.) What is the probability of an accident?

\[ P(\text{accident}) = \] ________________

c.) What is the probability of an accident or it is raining?

\[ P(\text{accident or raining}) = \] ________________

d.) What is the probability of an accident and it is raining?

\[ P(\text{accident and raining}) = \] ________________

e.) What is the probability of an accident given it is raining?

\[ P(\text{accident | raining}) = \] ________________

f.) What is the probability it is raining given an accident has occurred?

\[ P(\text{raining | accident}) = \] ________________

g.) What is the probability of an accident if it is not raining?

\[ P(\text{accident | not raining}) = \] ________________

h.) Does it appear that there is an association between rain and accidents? Explain.
Week 6: Aug 5-11

Why is the prerequisite for this course Algebra 2?

An AP Statistics course will not feel like a “regular” math course. The requirement for this course is a valid credit in Algebra 2. We will not use a large amount of the Algebra 2 you learned, however, the following is a good sampling of some of the things we would need you to be able to do.

Evaluate Expressions:

a.) \( \frac{x-\bar{x}}{s} \) when \( x = 83, \bar{x} = 91 \) and \( s = 4 \)

b.) \( \sqrt{\frac{pq}{n}} \) when \( p = .30, q = 1 - p \) and \( n = 23 \)

c.) \( \frac{s}{\sqrt{n}} \) when \( s = 17.03 \) and \( n = 20 \)

d.) \( \sqrt{\frac{p(1-p)}{n_1} + \frac{p(1-p)}{n_2}} \) when \( p = .34, n_1 = 24 \) and \( n_2 = 31 \)

e.) \( \log(\hat{y}) = 63.1 - 12.3x \) find \( \hat{y} \) when \( x = 4 \)

Solve Equations:

a.) \( \frac{1}{x} = 29 \) \hspace{2cm} b.) \( 1.645 = \frac{x-7}{13.2} \)

c.) \( \ln(x) = 3 \) \hspace{2cm} d.) \( \log(x) = 3 \)

e.) \( 0.03 = 2.33 \sqrt{\frac{(.38)(.62)}{x}} \) \hspace{2cm} f.) \( 4 = 1.96 \left( \frac{2.4}{\sqrt{x}} \right) \)

Create an interval:
Example: $6 \pm (1.64)(3.7) = (6 - (1.64)(3.7), 6 + (1.64)(3.7)) = (-0.068, 12.068)$

a.) $0.47 \pm (1.96)(0.03) = (\text{______________}, \text{______________}) = (\text{_______}, \text{_______})$

b.) $9 \pm (2.09)(2) = (\text{______________}, \text{______________}) = (\text{_______}, \text{_______})$

Find slope and y-intercept of a line:

a.) $y = \frac{2}{3}(2x - 4)$
   slope = ________________
   y-int = ________________

b.) $3x + 2y = 14$
   slope = ________________
   y-int = ________________

c.) $\frac{1}{2}y - 6x = 4$
   slope = ________________
   y-int = ________________

Write an equation of a line.

a.) Through (-2, 5) with a slope of 0.2
   $y = \text{__________________________}$

b.) Through (-6, -2) and (0, 5)
   $y = \text{__________________________}$

c.) Through (8, -3) and (2, -1)
   $y = \text{__________________________}$

Equation of a linear model:

Algebra: $y = mx + b$ where $m$ is slope and $b$ is the $y$ - intercept
Statistics: $\hat{y} = a + bx$ where $b$ is slope and $a$ is the $y$ - intercept

Re-write the following algebraic equations for a line into statistical linear models:

a.) $y = 6x + 3$
   $\hat{y} = \text{__________________________}$

b.) $y = -2.4x - 3$
   $\hat{y} = \text{__________________________}$

Interpret equations of a line:

It is important that you can use a linear model and interpret the meaning of its slope and y-intercept.
a.) The following equation can be used to predict the average height of boys anywhere between birth and 15 years old: \( \hat{y} = 25.64 + 2.79x \), where \( x \) is the age, in years, and \( \hat{y} \) is the predicted height, in inches.

i) Predict the height of a 10-year old boy.

ii) What is the slope of the linear model? What does it represent in this problem? Interpret it in the context of this situation.

iii) What is the \( y \)-intercept of the linear model? What does it represent in this problem? Interpret it in context.

iv) Does the \( y \)-intercept have a reasonable meaning?

b) The following linear model can be used to predict the weight (grams) of a bar of soap as it is used each day: \( \hat{y} = 133.2 - 6.31x \).

i) Define the variables: \( \hat{y} \) is ______________________________, \( x \) is ________________________

ii) Predict the weight of the soap on day 4.

iii) Interpret the slope of the model.

iv) Interpret the \( y \)-intercept. Does it have reasonable meaning?

v) For approximately how many days will the bar of soap last?
**Weeks 7 and 8: Aug 12-25**

**Practice problems with data!**

**Categorical or Quantitative?** Determine if the variables listed below are *quantitative* or *categorical*.

a. Time it takes to get to school  
b. Hair color  
c. Temperature of a cup of coffee  
d. Jellybean flavors  
e. Shoe size  
f. Wage  
g. Type of meat  
h. Country of origin  
i. Height  
j. Number of shoes owned

**Statisitic – what is that?** A statistic is a number calculated from data. Quantitative data have many different statistics that can be calculated. Determine the various statistics from the data below, the number of homeruns hit each season by a MLB player. Refer back to Week 2 to see how you can have the calculator do these for you!

<table>
<thead>
<tr>
<th>70</th>
<th>52</th>
<th>22</th>
<th>49</th>
<th>3</th>
<th>32</th>
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<td>Minimum</td>
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<tr>
<td>Median</td>
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<td></td>
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<td>Range</td>
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<td>Inter-Quartile Range</td>
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</tbody>
</table>

**Constructing a Bar Graph:**
ACCIDENTAL DEATHS

In 1997 there were 92,353 deaths from accidents in the United States. Among these were 42,340 deaths from motor vehicle accidents, 11,858 from falls, 10,163 from poisoning, 4051 from drowning, and 3601 from fires. The rest were listed as “other” causes.

a. Find the percent of accidental deaths from each of these causes, rounded to the nearest percent.

b. What percent of accidental deaths were from “other” causes?

c. NEATLY create a well-labeled bar graph of the distribution of causes of accidental deaths. Be sure to include an “other causes” bar.
Constructing a Doplot:

IT'S A TWISTA
The data below gives the number of hurricanes that happened each year from 1944 through 2000 as reported by Science magazine.

| 3 | 2 | 1 | 4 | 3 | 7 | 2 | 3 | 3 | 2 | 5 | 2 | 2 | 4 | 2 | 2 | 6 | 0 | 2 | 5 | 1 | 3 | 3 | 1 | 0 |
| 3 | 2 | 1 | 0 | 1 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 1 | 1 | 1 | 3 | 0 | 1 | 3 | 2 | 1 | 2 | 1 |
| 1 | 0 | 5 | 6 | 1 | 3 | 5 | 3 |

a. Make a dotplot to display these data. Make sure you include appropriate labels, title, and scale. The graph paper should help ensure you space your markings (you may use x’s or dots) consistently.
**Constructing a Stemplot (Stem-and-Leaf Plot):**

A marketing consultant observed 50 consecutive shoppers at a supermarket. One variable of interest was how much each shopper spent in the store. Here are the data (round to the nearest dollar), arranged in increasing order:

<table>
<thead>
<tr>
<th></th>
<th>3</th>
<th>9</th>
<th>9</th>
<th>11</th>
<th>13</th>
<th>14</th>
<th>15</th>
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<tr>
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<td>83</td>
<td>86</td>
<td>86</td>
<td>93</td>
<td></td>
</tr>
</tbody>
</table>

a. Make a stemplot using tens of dollars as the stem and dollars as the leaves. Make sure you include appropriate labels, title and key.
Constructing a Histogram:

WHERE DO OLDER FOLKS LIVE?
This table gives the percentage of residents aged 65 or older in each of the 50 states.

<table>
<thead>
<tr>
<th>State</th>
<th>Percent</th>
<th>State</th>
<th>Percent</th>
<th>State</th>
<th>Percent</th>
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<tbody>
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<td>Alabama</td>
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<td>12.5</td>
<td>Rhode Island</td>
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</tr>
<tr>
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<td>South Carolina</td>
<td>12.2</td>
</tr>
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<td>Vermont</td>
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</tr>
<tr>
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</tr>
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<td>North Carolina</td>
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<td>Kentucky</td>
<td>12.5</td>
<td>North Dakota</td>
<td>14.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Histograms are a way to display groups of quantitative data into bins (the bars). These bins have the same width and scale and are touching because the number line is continuous. To make a histogram you must first decide on an appropriate bin width and count how many observations are in each bin. The bins for percentage of residents aged 65 or older have been started below for you.

a. Finish the chart of Bin widths and then create a histogram using those bins on the grid below. Make sure you include appropriate labels, title and scale.

<table>
<thead>
<tr>
<th>Bin Widths</th>
<th>Frequency</th>
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<tr>
<td>4 to &lt; 6</td>
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<td>6 to &lt; 8</td>
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<tr>
<td>8 to &lt; 10</td>
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<tr>
<td></td>
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</tbody>
</table>
Wow, that was a lot! But “well-done” for getting this far. If you have had questions, please be sure to ask during the first couple days of class. Reminder that this is worth half of your first test score. I’m looking forward to a great year of AP Statistics. I hope you are too!

See you on August 27!